

## WHAT IS CLAIMED IS:

1 1. An apparatus having an inter-module data transfer  
2 confirming function comprising:  
3           a first module;  
4           a second module;  
5           a bridge module connected said first module  
6 and said second module through interface buses to  
7 connect said first module and said second module to  
8 each other so that data can be transferred between said  
9 first module and said second module; and  
10           a confirmation code setting means for setting,  
11 in said bridge module, a confirmation code for  
12 confirming data transfer from said bridge module to  
13 said second module when said first module transfers  
14 data to said second module via said bridge module  
15 through said interface buses;  
16           said first module comprising:  
17               a descriptor setting means for  
18 setting a data transfer descriptor containing  
19 transfer information required for data transfer to  
20 said second module and a data transfer confirmation  
21 flag;  
22               a descriptor generating means for  
23 automatically generating, when said data transfer  
24 confirmation flag is "ON", a data transfer  
25 confirmation descriptor containing confirmation code

26 reading information, which is required to read out  
27 said confirmation code from said bridge module to said  
28 first module, on the basis of said transfer  
29 information in said data transfer descriptor set by  
30 said descriptor setting means; and

31                   a controlling means for controlling  
32 data transfer to said second module according to said  
33 transfer information in said data transfer descriptor  
34 set by said descriptor setting means, and for  
35 controlling, when said data transfer confirmation  
36 flag is "ON", after the data transfer to said second  
37 module is completed, reading of said confirmation code  
38 from said bridge module according to said confirmation  
39 code reading information in said data transfer  
40 confirmation descriptor automatically generated by  
41 said descriptor generating means.

1 2. The apparatus having an inter-module data transfer  
2 confirming function according to claim 1, wherein said  
3 first module comprises:

4                   a first processing unit for generally  
5 managing said first module;

6                   a second processing unit for carrying out  
7 data transfer through said interface buses according  
8 to an instruction from said first processing unit;

9                   said first processing unit fulfilling a  
10 function as said descriptor setting means; and

11           said second processing unit fulfilling  
12 functions as said descriptor generating means and said  
13 controlling means.

1   3. The apparatus having an inter-module data transfer  
2 confirming function according to claim 1, wherein said  
3 first module further comprises:

4           a first determining means for determining  
5 whether data transfer between said bridge module and  
6 said second module has been carried out normally or  
7 abnormally, on the basis of said confirmation code  
8 read out from said bridge module; and

9           a second determining means for determining  
10 whether data transfer between said first module and  
11 said bridge module has been carried out normally or  
12 abnormally.

1   4. The apparatus having an inter-module data transfer  
2 confirming function according to claim 3, wherein when  
3 said first determining means determines that the data  
4 transfer has been carried out abnormally, said  
5 descriptor generating means automatically generates  
6 an error reading descriptor containing error reading  
7 information required to read out detailed error  
8 information from said bridge module to said first  
9 module, and said controlling means controls reading  
10 of said detailed error information from said bridge

11 module according to said error reading information in  
12 said error reading descriptor automatically  
13 generated by said descriptor generating means.

1 5. The apparatus having an inter-module data transfer  
2 confirming function according to claim 4, wherein said  
3 first module comprises:

4 a first processing unit for generally  
5 managing said first module;

6 a second processing unit for carrying out  
7 data transfer through said interface buses according  
8 to an instruction from said first processing unit;

9 said first processing unit fulfilling  
10 functions as said descriptor setting means and said  
11 second determining means; and

12 said second processing unit fulfilling  
13 functions as said descriptor generating means, said  
14 controlling means and said first determining means.

1 6. The apparatus having an inter-module data transfer  
2 confirming function according to claim 5, wherein when  
3 said second determining means determining that the  
4 data transfer has been carried out abnormally, said  
5 first processing unit obtains, from said second  
6 processing unit, said detailed error information read  
7 out from said bridge module, and instructs said second  
8 processing unit to re-transfer the data on the basis

9 of said detailed error information.

1 7. The apparatus having an inter-module data transfer  
2 confirming function according to claim 1, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 8. The apparatus having an inter-module data transfer  
2 confirming function according to claim 2, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 9. The apparatus having an inter-module data transfer  
2 confirming function according to claim 3, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among

8 said plurality of data blocks to "ON".

1 10. The apparatus having an inter-module data transfer  
2 confirming function according to claim 4, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 11. The apparatus having an inter-module data transfer  
2 confirming function according to claim 5, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 12. The apparatus having an inter-module data transfer  
2 confirming function according to claim 6, wherein when  
3 a plurality of data blocks are successively  
4 transferred from said first module to said second  
5 module, said descriptor setting means sets only said  
6 data transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among

8    said plurality of data blocks to "ON".

1    13. A storage controlling apparatus disposed between  
2    a disk unit and a host to control an access to said  
3    disk unit from said host, said storage controlling  
4    apparatus comprising:

5           a disk interface module for controlling an  
6    interface with said disk unit;

7           a host interface module for controlling an  
8    interface with said host;

9           a management module for generally managing  
10   the whole of said apparatus;

11          a bridge module connected said disk interface  
12   module, said host interface module and said management  
13   module through interface buses to connect said disk  
14   interface module, said host interface module and said  
15   management module to one another so that data can be  
16   transferred among said disk interface module, said  
17   host interface module and said management module; and

18          a confirmation code setting means for setting,  
19   in said bridge module, a confirmation code for  
20   confirming data transfer from said bridge module to  
21   said management module when said disk interface module  
22   or said host interface module transfers data to said  
23   management module via said bridge module through said  
24   interface buses;

25          said disk interface module and/or said host

26 interface module (hereinafter referred simply as said  
27 interface module) comprising:

28                   a descriptor setting means for  
29 setting a data transfer descriptor containing  
30 transfer information required for data transfer to  
31 said management module and a data transfer  
32 confirmation flag;

33                   a descriptor generating means for  
34 automatically generating, when said data transfer  
35 confirmation flag is "ON", a data transfer  
36 confirmation descriptor containing a confirmation  
37 code reading information, which is required to read  
38 out said confirmation code from said bridge module to  
39 said interface module, on the basis of said transfer  
40 information in said data transfer descriptor set by  
41 said descriptor setting means; and

42                   a controlling means for controlling  
43 data transfer to said management module according to  
44 said transfer information in said data transfer  
45 descriptor set by said descriptor setting means, and  
46 for controlling, when said data transfer confirmation  
47 flag is "ON", after the data transfer to said  
48 management module is completed, reading of said  
49 confirmation code from said bridge module according  
50 to said confirmation code reading information in said  
51 data transfer confirmation descriptor automatically  
52 generated by said descriptor generating means.

1 14. The storage controlling apparatus according to  
2 claim 13, wherein said interface module comprises:  
3 a first processing unit for generally  
4 managing said interface module;  
5 a second processing unit for carrying out  
6 data transfer through said interface buses according  
7 to an instruction from said first processing unit;  
8 said first processing unit fulfilling a  
9 function as said descriptor setting means; and  
10 said second processing unit fulfilling  
11 functions as said descriptor generating means and said  
12 controlling means.

1 15. The storage controlling apparatus according to  
2 claim 13, wherein said interface module comprises:  
3 a first determining means for determining,  
4 on the basis of said confirmation code read out from  
5 said bridge module, whether data transfer between said  
6 bridge module and said management module has been  
7 carried out normally or abnormally; and  
8 a second determining means for determining  
9 whether data transfer between said interface module  
10 and said bridge module has been carried out normally  
11 or abnormally.

1 16. The storage controlling apparatus according to

2 claim 15, wherein when said first determining means  
3 determines that the data transfer has been carried out  
4 abnormally, said descriptor generating means  
5 automatically generates an error reading descriptor  
6 containing error reading information required to read  
7 out detailed error information from said bridge module  
8 to said interface module, and said controlling means  
9 controls reading of said detailed error information  
10 from said bridge module according to said error  
11 reading information in said error reading descriptor  
12 automatically generated by said descriptor  
13 generating means.

1 17. The storage controlling apparatus according to  
2 claim 16, wherein said interface module comprises:  
3 a first processing unit for generally  
4 managing said interface module;  
5 a second processing unit for carrying out  
6 data transfer through said interface buses according  
7 to an instruction from said first processing unit;  
8 said first processing unit fulfilling  
9 functions as said descriptor setting means and said  
10 second determining unit; and  
11 said second processing unit fulfilling  
12 functions as said descriptor generating means, said  
13 controlling means and said first determining means.

1 18. The storage controlling apparatus according to  
2 claim 17, wherein when said second determining unit  
3 determines that the data transfer has been carried out  
4 abnormally, said first processing unit obtains, from  
5 said second processing unit, said detailed error  
6 information read out from said bridge module, and  
7 instructs said second processing unit to re-transfer  
8 the data on the basis of said detailed error  
9 information.

1 19. The storage controlling apparatus according to  
2 claim 13, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 20. The storage controlling apparatus according to  
2 claim 14, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 21. The storage controlling apparatus according to  
2 claim 15, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 22. The storage controlling apparatus according to  
2 claim 16, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 23. The storage controlling apparatus according to  
2 claim 17, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 24. The storage controlling apparatus according to  
2 claim 18, when a plurality of data blocks are  
3 successively transferred from said interface module  
4 to said management module, said descriptor setting  
5 means sets only said data transfer confirmation flag  
6 in a data transfer descriptor for transferring the  
7 last data block among said plurality of data blocks  
8 to "ON".

1 25. An interface module for a storage controlling  
2 apparatus disposed between a disk unit and a host to  
3 control an access from said host to said disk unit,  
4 said storage controlling apparatus comprising said  
5 interface module for controlling an interface with  
6 said disk unit or said host, a management module for  
7 generally managing the whole of said storage  
8 controlling apparatus, a bridge module connected said  
9 interface module and said management module through  
10 interface buses to connect said interface module and  
11 said management module to each other so that data can  
12 be transferred between said interface module and said  
13 management module, and a confirmation code setting  
14 means for setting, in said bridge module, a  
15 confirmation code for confirming data transfer from  
16 said bridge module to said management module when said  
17 interface module transfers data to said management

18 module via said bridge module through said interface  
19 buses, said interface module comprising:

20           a descriptor setting means for setting a data  
21 transfer descriptor containing transfer information  
22 required for data transfer to said management module  
23 and a data transfer confirmation flag;

24           a descriptor generating means for  
25 automatically generating, when said data transfer  
26 confirmation flag is "ON", a data transfer  
27 confirmation descriptor containing confirmation code  
28 reading information, which is required to read out  
29 said confirmation code from said bridge module to said  
30 interface module, on the basis of said transfer  
31 information in said data transfer descriptor set by  
32 said descriptor setting means; and

33           a controlling means for controlling data  
34 transfer to said management module according to said  
35 transfer information in said data transfer descriptor  
36 set by said descriptor setting means, and for  
37 controlling, when said data transfer confirmation  
38 flag is "ON", after the data transfer to said  
39 management module is completed, reading of said  
40 confirmation code from said bridge module according  
41 to said confirmation code reading information in said  
42 data transfer confirmation descriptor automatically  
43 generated by said descriptor generating means.

1 26. The interface module for a storage controlling  
2 apparatus according to claim 25 comprising:

3           a first processing unit for generally  
4 managing said interface module;

5           a second processing unit for carrying out  
6 data transfer through said interface buses according  
7 to an instruction from said first processing unit;

8           said first processing unit fulfilling a  
9 function as said descriptor generating means; and

10           said second processing unit fulfilling  
11 functions as said descriptor generating means and said  
12 controlling means.

1 27. The interface module for a storage controlling  
2 apparatus according to claim 25 further comprising:

3           a first determining means for determining  
4 whether data transfer between said bridge module and  
5 said management module has been carried out normally  
6 or abnormally, on the basis of said confirmation code  
7 read out from said bridge module; and

8           a second determining means for determining  
9 whether data transfer between said interface module  
10 and said bridge module has been carried out normally  
11 or abnormally.

1 28. The interface module for a storage controlling  
2 apparatus according to claim 27, wherein when said

3 first determining unit determines that the data  
4 transfer has been carried out abnormally, said  
5 descriptor generating means automatically generates  
6 an error reading descriptor containing error reading  
7 information required to read out detailed error  
8 information from said bridge module to said interface  
9 module, and said controlling means controls reading  
10 of said detailed error information from said bridge  
11 module according to said error reading information in  
12 said error reading descriptor automatically  
13 generated by said descriptor generating means.

1 29. The interface module for a storage controlling  
2 apparatus according to claim 28 comprising:  
3       a first processing unit for generally  
4 managing said interface module;  
5       a second processing unit for carrying out  
6 data transfer through said interface buses according  
7 to an instruction from said first processing unit;  
8       said first processing unit fulfilling  
9 functions as said descriptor setting means and said  
10 second determining unit; and  
11       said second processing unit fulfilling  
12 functions as said descriptor generating means, said  
13 controlling means and said first determining means.

1 30. The interface module for a storage controlling

2 apparatus according to claim 29, wherein when said  
3 second determining means determines that the data  
4 transfer has been carried out abnormally, said first  
5 processing unit obtains, from said second processing  
6 unit, said detailed error information read out from  
7 said bridge module, and instructs said second  
8 processing unit to re-transfer the data on the basis  
9 of said detailed error information.

1 31. The interface module for a storage controlling  
2 apparatus according to claim 25, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 32. The interface module for a storage controlling  
2 apparatus according to claim 26, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 33. The interface module for a storage controlling  
2 apparatus according to claim 27, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 34. The interface module for a storage controlling  
2 apparatus according to claim 28, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 35. The interface module for a storage controlling  
2 apparatus according to claim 29, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".

1 36. The interface module for a storage controlling  
2 apparatus according to claim 30, wherein when a  
3 plurality of data blocks are successively transferred  
4 from said interface module to said management module,  
5 said descriptor setting means sets only said data  
6 transfer confirmation flag in a data transfer  
7 descriptor for transferring the last data block among  
8 said plurality of data blocks to "ON".